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Realisation and evaluation of the web based instruction courseware: Turkey example

Mustafa Meral ^{a*}, Esmâ Colak ^b, H.Hakan Genc^c

^a Marmara University, Göztepe, Istanbul 34722, Turkey

^b Mimar Sinan Fine Arts University, Bomonti Şişli, Istanbul 34380, Turkey

^c Sapanca ATL, TL, METEM, Sapanca, Sakarya 54600, Turkey

Abstract

As educators are increasingly using and developing courseware to use with their students, it gets more important to understand how high quality courseware should be designed, developed and used. In this study, based on this idea, a web based instructional design for Electronics course was developed for the vocational high school Electronics Department grade 2. In this study, the purpose is to present the development and evaluation process of the courseware and to support the creation of quality designs. The study was based on the survey model. A scale called “Technical and Pedagogical Bases of Web Based Instruction” was developed by the researchers to assess the instructional design and this scale was applied to the educators teaching this course. The scope of the study is the teachers in electricity, electronics and computer departments in Vocational and Anatolian Vocational-Technical High Schools in Istanbul city. Simple random selection method was used and 8 of the 11 schools were selected as sample. Web based instruction design was decided to be put into effect the revision based on the findings obtained. Future researches should investigate perceived differences in the learning experience between a face-to-face versus an online environment.

Keywords: Courseware design, courseware development, evaluation of courseware, instructional design, web based instruction;

1. Introduction

Today, one of the major problems of traditional education is in balance between the supply and demand. One of the leading alternative solutions to deal with this problem is web-based instruction. Web-based instruction carries a characteristic for those who wish to develop vocational education on web-based instruction, and has a role in helping the individuals to continue their education scientifically, culturally and contemporarily. This problem is especially important for developing countries such as Turkey where 75% of the population is under the age of 35 for which the education and instruction is vitally important.

Web based instruction (WBI) is a course delivered to students who do not meet in a traditional classroom; these students take the course from a remote location via the Internet. In this study, the term is used interchangeably with the term online instruction (Zhang, 2005).

Some have predicted that within ten years, 50% of students enrolled in higher education will be distance learners or will be studying in a distance learning environment. (Kascus, 1997). Based on the findings of a web based survey which was conducted to response to the recent explosion of online training in work-related settings in 2001, 67 % of

*Mustafa Meral, Tel.: +905353662182
E-mail address: meralm@marmara.edu.tr

respondents felt that their instructional load would be at least 50 percent online within ten years (Bonk, 2002). The case is no different in Turkey. According to the results of the study ‘The Importance of Internet in The Development of Vocational Education and Instruction’ conducted by Writer (2002), internet use has increased in education and instruction sharply, and has been welcomed by students and teachers alike. Moreover, a study, carried out by Writer and Writer (2003) with the aim of determining the internet use profile of the master students in Marmara University Technical Education Faculty departments, has revealed that internet use rate is %69, 5 in master and doctorate lessons. These results show that in almost every country in the world, from America to Turkey, there is an increase in the use of internet and web based instruction.

With the support of the reasons mentioned above, instruction designers seem to be really willing to adapt their traditional approach to the new web based instruction method. It can be said that web based instruction provides better education experience than classical class atmosphere or diskette/CD based applications. In web based instruction system students take part and manage the lesson. Students decide to take which subject to choose, at what level and for how long. Students are not only passive listeners but also participating responsive ones. Thus, they have the opportunity to check themselves and follow their progress (Horton, 2000). Also, scientific argumentations, investigating the questions or the use of web based technologies by the students support development of students' higher-order thinking and problem-solving skills (Barron and Goldman, 1994).

The use of contemporary learning methods depending on teamwork , such as cooperative learning (Baron and Goldman, 1994), problem based learning and project based learning are also supported by WBI. Learners are able to discuss, exchange their ideas and brain storm between those from different areas, cities, or even countries.

Considering the advantages mentioned above, the biggest problem regarding the web based instruction that has placed itself in the education process of our time lies in the efficiency of WBI. That some WBI applications have no effect in their movement to the internet leaves WBI with the troubles of the traditional education. The literature indicates that a critical factor to the success of WBI is the incorporation of usability design into the development process (Henke, 2001).

Considering this point, it is hardly wrong to say that the point reached on WBI is the instructional design process. Although online distance education witnesses a rapid development, pedagogical research on Web-based instruction does not keep pace with the growth (Newlin & Wang, 2002; as cited in Zhang, 2005). We are still relatively ignorant about the most effective ways of conducting and organizing this mode of instruction. Each institution is offering its online courses in the hope of targeting traditional as well as non-traditional students and consequently expanding the enrolments. But faculty participants of online instruction, in general, start teaching online courses with little or no training about the pedagogical and technological needs in the online environment (Flowers, 2002; as cited in Zhang, 2005).

Su, Bonk, Magjuka, Liu & Lee (2005) state that:

“while increasing enrolment is certainly desirable from an administrative perspective, there is a growing concern about the program quality. How can universities guarantee quality online programs when in the midst of such explosive growth? What are the exemplary pedagogical experiences that can help establish a high quality online program? These questions are not new in the field; however, answers to these questions are slow in emerging.” (2005: 1)

What the educators agree at this point is that WBI programs should be moved to a different profile than traditional internet environment. Therefore, it is necessary to define the design process effectively. The design of WBI requires a long and intensive work as well as a wide range of experts from programmers to web designers.

Once the model is decided on, it is necessary to define the goals and outcomes. In the report which states the models mentioned above, it is observed that in many schools information technology based lectures add to the learning only as much as their traditional alternatives rather than improving the quality of learning. Technology is just a tool, knowing how to use a word-processor does not guarantee one that he or she can write a good book. Similarly, internet can't grant a higher education quality only by itself. A successful online web based education

depends on forming a strategy which combines the technology with an organised group who are ready and willing to use it (Rosenberg, 2001)

It is importance that pedagogical side is not ignored in the designed web-based instruction. Instructional principals required by contemporary instruction, learning strategies compatible with active learning, real life situations and the range of interaction are the point to be focused on WBI. As emphasised above, WBI designs are more than transferring the written information to the individuals, based on multi way communication and effect to lead the individuals to the desired goals, active learning in essence, considering the individual differences and cooperative works should have a supportive role in learning process.

However, although our country has not reached to that level yet, there are steps taken forward to make the necessary arrangements. Distance Learning Regulations based on Interuniversity Communication and Information Technology drafted by Higher Education Council was put into effect after the publication in the Official Paper date December 14 in 1999. The aim of the Distance Learning Regulations is to ease the academic collaboration among them in pre-graduate, graduate, and post-graduate education based on communication and information technologies, to reach the communicative atmosphere and multiple atmosphere, multidimensional facilities through which to increase the instruction efficiency, to make higher education available to a greater community and to increase its efficiency (YOK, 2007). Furthermore, it is seen that in such state universities as Middle East Technical University, Sakarya, Bogazici and some private universities, some post graduate and graduate lectures are given web-based. However, for full consciousness in web-based instruction, a lot is to be done. Specifically, technological literacy of the future brain power is to be achieved in secondary school, or even earlier. In this study, based on this idea, a web based instructional design for Electronics course is developed aiming to train and educate people according to the industries' need.

In this study, a web-based material in the field of electronics has been developed and courseware suitability has been discussed with the responses from the experts on this subject. A scale was also developed by the researchers to assess the prepared design and this scale was applied to the educators teaching this course and revised for use by students depending on the results obtained. The reason for the Electronics course to be chosen as the lecture is its suitability to be taught in the internet environment in modular structure while it is possible to reach wide communities with its structure of gaining professions among the life time learning subjects. Furthermore, the preparation of electronic circuit samples, it's easy adaptation on fictional dimension of the science and because of lack of time and space limitations, realisation of certain things for prepared web sites, its accessibility are important in terms of creation of permanent traces.

Also in this study, the aim is to increase the competitiveness of Education Ministry in Turkey and to support the steps taken on the way of EU, and to try to fill in the gap in the WBI area. The developed courseware has also been improved based on modular programming techniques under the MEGEP (Vocational Education Development Project) project. In this sense, being supportive of the MEGEP project, it aims at using the most recent vocational technical developments. Also, through the light of the developed courseware, it is aimed at developing new suggestions and supporting the creation of quality designs. That is why in the current study, the following research questions were addressed:

1. Is the Analog Circuit Devices Courseware (ACDC) technically adequate?
2. Is the ACDC suitable in terms of target group?
3. Is the ACDC effective in terms of web design?
4. Is the ACDC effective in terms of clarity of the site?
5. Is the ACDC in terms of qualitative characteristics of the developed questions?

2. Method

2.1. Research Model and Participants

The study was based on the survey model. The scope of the study is the teachers that work in electricity, electronics and computer departments in Vocational and Anatolian Vocational-Technical High Schools in Istanbul city. Simple random selection method was used and 8 of the 11 schools were selected as sample. A total of 191

scales were distributed to the teachers for the evaluation of the WBI material and 139 scales were returned back from the teachers.

2.2. Instruments

In the study, a scale which was called “Technical and Pedagogical Bases of WBI” developed by the researchers to assess the instructional design. First of all, subject matter experts from Technical Education Faculty Computer-Electronics were asked about their suggestions on the web based instruction and a pool of 54 expressions was formed. Then, based on the advice of the specialist, the expressions were reduced to 35 and the measurement tool was prepared as fivepoint scale.

The scale was presented to 139 pre-service teachers. The data obtained was evaluated by the package program SPSS. The discriminating, the item total and the item remainder values of the scale items were found significant at the 0.05 level. Factor analysis was conducted to examine construct validity of the scale. Equamax rotation method was performed to determine the pattern of relationships of the subscales of the scale. The Kaiser-Meyer-Olkin measure of sample adequacy was 0,62, and Barlett test of sphericity was found significant ($p < 0.05$). As a result, five factors explain 68,95% of total variance were extracted. After a closer examination of the loading on the factors (in the interpretation used loading greater than 0,40), it has seen that factor loads of the materials available in the measurement vary between 0.50 and 0.89. each item in the factors were checked and the factors was named as follow: Factor 1 “Technical Infrastructure”, factor 2 “Suitability for The Target Group”, factor 3 “Web Design Proficiency”, Factor 4 “Clarity of The Site”, Factor 5 “Qualitative Efficiency of Question” are the titles used.

Reliability analysis shows that scale had internal consistency. Cronbach’s alpha calculated as 0,79 for whole scale. In the final measurement, scale consists of 16 items. The reported factor structure of the scale enables the calculation of scores by summing the Likert responses to the 16 questions identified for each subscale.

2.3. Developing The Courseware

The courseware has been prepared in four stages: “Goal and Outcomes, Content, Design and Evaluation”. The design was developed based on these four stages and was explained in the design process. The following design development period was presented below.

2.4. Courseware Goals and Outcomes

In this study, the target group is the students that study in vocational high school Electronics Department grade 2. The students of the same age that had received basic information about electronics in grade 1. In this study, as it was tried to develop the courseware designed for Vocational High school Electronics course, lesson goals and outcomes stated by the Council of Education Policy attached to the Ministry of Education were based on.

2.5. Courseware Content

“Analog Circuit Devices Lesson” is based on the curriculum of the Basic Electronics, determined by Ministry of Education. In this study, ‘Passive Circuit Elements’ and ‘Semiconductor Circuit Elements’ subjects, suitable to the aims and matching each other meaningfully, were prepared as modules each. For the preparation of the contents of the modules, different sources were analyzed for use (MEB, 2005; Clips, 2006). The opinions of the subject matter teachers were taken following the analysis of subjects in the instructional program in terms of the degree of correspondence with the course outcomes. The content formed was investigated by two subject area experts, followed by necessary revisions, the last revision was established.

2.6. Courseware Design

This stage is focused on how to realise the instructional process. As instructional design model, basically system approach was used. The reason for the system approach to be used is that instructional system is thought to be related to each other. The focus point here is what the students are supposed to know to achieve learning. Secondly, each item in the instructional process is related to each other; each item has its own pros and cons; the whole system is designed in relation to each other (Curzon, 1990). It is thought that all these considerations will lead to a better understanding in the structure of web based instruction.

Moreover, constructive components were added to the structure to make it learner-based. In order to enrich the communication level, links, discussion groups, search engines, active e-mail structure, samples for students' real life situation environments, and questions to lead the students to investigating and thinking were included.

The pedagogical aspect for this study built on the seven principles of good undergraduate education as it was laid out by Chickering and Gamson **Model** (1987; as cited in **Shufang&Blaine, 2006**) which are used to identify the pedagogical quality in this study. During the design process, each item in the defined modules was prepared as a separate web page. Instruction management (LMS) system MOODLE (Modular Object Oriented Dynamic Learning Environment) was used to observe the students and to grant the communication between students and lecturers. In the present study, Flash software and Java programming was used in order to revive certain circuit elements and to realize circuit similarities.

2.7. Courseware Evaluation

Web-based electronics course material hosted on a web page for the evaluation of the teachers. The scale called "Technical and Pedagogical Bases Web-based instruction" was delivered to the teachers taking part of the survey. Teachers were asked to enter their users, passwords and fill in the questionnaire based on their views. Teachers were given about two weeks to answer the related questions and they were collected back at the end of the due course.

2.8. Data Analysis

SPSS package program was used in statistical data analysis. In the study, a scale which was called "Technical and Pedagogical Bases of WBI" developed by the researchers to assess the instructional design. To examine construct validity of this scale, factor analysis was conducted For the internal consistency of the scale, Cronbach's alpha calculated. For the validity of the courseware designed; mean, arithmetic mean, median, mode, standard deviation for every factor and mean values for every item was used.

3. Findings

The main aim of the study is to try out the validity of the courseware designed. In order to reach this goal, the scale was applied to the technical educators and findings were searched for determining the proficiency level.

At this stage, evaluations for each factor were investigated. Thus, it will be easier to determine whether the system is efficient. Findings obtained from the factors are given in Table 1.

Table 1: Statistics related to the values of factors

	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Grand Total
Mean	15,92	11,27	15,54	11,26	7,88	61,89
Arith.Mean	3,98	3,75	3,88	3,75	3,94	3,86
Median	16,00	11,00	15,00	11,00	8,00	62,00
Mode	16,00	12,00	15,00	11,00	8,00	60,00
Std. Dev.	2,68	1,21	1,77	1,57	,93	5,47

Table 1 shows the statistics related to the Factors. Arithmetic mean is calculated when the mean value is divided by expression number in the factor. When Table 1 is examined in terms of factors, the arithmetic mean is 3,98 for Factor 1, 3, 75 for Factor 2, 3, 88 for Factor 3, 3, 75 for Factor 4, 3,94 for Factor 5. According to all of the arithmetic means, it can be expressed that the evaluation of factors is based on “Agree” which is pointed by 4 in the 5 items likert type measurement.

In the study also the mean of each item was checked out, the findings are in Table 2.

Table 2: Mean values of each item

Factors	Items	Mean
Factor 1	1	4,1511
	2	4,0504
	3	4,0216
	4	3,8921
Factor 2	5	3,5827
	6	3,8993
	7	3,8345
Factor 3	8	3,9209
	9	4,0647
	10	3,7626
	11	3,7770
Factor 4	12	3,7842
	13	3,8489
	14	4,0360
Factor 5	15	3,6619
	16	3,8058

As seen in the Table 2, mean for each item ranges from 3,5 to 4,1. The lowest value in terms of factor 1 is item 4 about organizing the connection lists. The means in terms of factor 2 are quite close to each other. The lowest value is in item 5. When this item is checked out, it is seen to be about the suitability of the questions to the target group. In terms of factor 3, item 10 and 11 have lower cases.

When these items are checked out, they are seen to be about the suitability of form items across the page and the attractiveness of the text. In terms of factor 4, item 12 has a lower case. When this item is looked into, it seems to be about the help menu. In factor 5, item 15 has lower cases. When this item is checked out, it seems to be about the teaching ability of the questions.

4. Discussion, Consequences and Suggestions

The way of increasing the positive effect of WBI on learning depends on the effective development of WBI and their evaluation in terms of their efficiency. In this study a WBI was developed, which was evaluated with the use of a tool designed by developers.

The design was tried out by the participants in all dimensions and all these evaluations were seen to be towards “Agree” which is referred by 4 on 5 item likert type measurement. This case strongly suggested that the developed design was evaluated as positive. Moreover, the mean values for each expression were examined. Based on these

findings, expressions with the lowest points were examined and decided to make changes in the WBI due to these expressions. The changes were listed below:

- Reorganizing of the connection lists (planning),
- Overviewing the questions for suitability to the target group
- Rearranging the choice buttons, and formal items like insert boxes and attractive items such as bold characters, colors, effects
- Enriching the content of the site help box
- Increasing the teaching quality of the questions

WBI application evaluation process will help avoiding useless designs. Thus, as we did in this study, teacher's or subject matter experts' assessments are an alternative to avoid useless designs. The results of assessments must be paid attention and revisions must be done. Evaluation is an endless process, so subject matter experts assess the web based instructional designs in different times. Teachers' assessments also give an idea about students' opinions. And it is important to see the pros and cons in the design from students' perspectives. Because in literature it is important to define what WBI applications students like to use and what handicaps they think to face. For example, Alghazo (2006) noted that in his study:

"Students mentioned many advantages of Web-enhanced instruction. Those included discussing course content through the discussion board, communicating with the course instructor and classmates, obtaining grades electronically, increase of course understanding, having access to course-related materials and submitting assignments through the Web. However, students see some obstacles to web-enhanced instruction such as: low speed of the internet, difficult access from outside university labs, and the limited access to computer labs. They reported that these obstacles deprived them sometimes from participation in discussion and enjoying other features of the Web component of the course". (2006: 6)

To know in what way the developed design is positive or negative is important to make the students more satisfied about WBI. Studies on distance education tend to focus mainly on instructors' activities, such as satisfaction and teaching methods, and on student outcomes, such as achievement, grades, and test scores (Biggs, Simpson and Walker, 2006). However, the way to make WBI effective on academic success is to define the determinants the students thoughts seem to ease instruction that makes it harder. When determinants of psychosocial educational components are better understood, instructors then have opportunities to make changes in their distance-based classes in order to improve the distance learning environment the learning outcomes of their distance education students.

If as Nichols (1995; as cited in Henke, 2001) predicts that the Web will likely soon become the most popular medium for the delivery of distance education type materials. This means that much additional research in different subject matters will be needed. The aim of this study is to develop a WBI design and evaluation of web design. There are many other issues in this area. To establish effective web based instructional designs, there are a lot of variables to research.

Because, web-based distance learning effort must include a variety of learning principles and address the learning issues incorporating strategies to engage and challenge the learner. In addition, the courseware must be usable and include the usability properties such as simplicity, comfort, user-friendly, user control, uncluttered/readable information, enough information, visible/readable links, good navigation, high/readable color contrast, understandable key points, appropriate font type/size, and load time (Koohang and Weiss, 2003). In terms of all these areas are needed to research. Mathew and Poirier (2000: 9) suggest that "There is much research to be done, both in terms of our knowledge of learning and in Web-based Instruction." Supporting this idea, in this context, development of different WBI for different education stages in different areas, evaluations of the designs and sharing the results obtained are what must be considered in future designs.

In addition to these, online pedagogy, the instructional model also must be focused. Attention must be given all the variables in web based instructional design. Future researches should investigate perceived differences in the learning experience between a face-to-face versus an online environment. Additional research is suggested to

identify the instructional design and the delivery of the best-practices for asynchronous, synchronous, and the emerging “blended” environments.

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